Integration of microalgae cultivation with wastewater for sustainable biofuel production

At the current rate of consumption, it is believed that the known fossil-fuel resources may get exhausted in less than 50 years. In the past decades, much attention has been focused on alternative renewable energy sources, especially biofuel production through microalgae. Coupling of wastewater with microalgae cultivation provides an effective means of utilizing nitrogen and phosphorus with lipid accumulation for biodiesel production. Algae are capable of absorbing nutrients with CO_2 and produce biomass through photosynthesis. A variety of green algae (Chlorophyceae), blue-green algae (Cyanophyceae) and diatoms (Bacillariophyceae) are commonly found species, profusely growing in wastewater with high biomass and lipid productivity. Microalgae can perform the dual function of phycoremediation and biofuel production. Selection of proper species of microalga having high lipid productivity and nutrient removal property is the key for effective coupling of wastewater treatment and biodiesel production. There is a great potential for exploitation of different wastewater sources like domestic, industrial, municipal and agricultural sources for harnessing of algal diversity for biofuel feedstock. It is uneconomical to use artificial media for large-scale biofuel production, but using wastewater for algal growth will result in substantial cost reduction.

In this context, the Department of Biotechnology, Kumaun University, Nainital is engaged in bioprospecting of microalgae that have potential for biofuel production from primarily domestic and industrial sources of wastewater. Screening algal strains on the basis of lipid productivity, to assess their ability to grow in wastewater is being assessed. Presently, isolation and purification of algal isolates have been completed and they are maintained in BG11 medium with routine microscopic checking for their purity. The algal strains were isolated and purified[1] from different wastewater habitats of Uttarakhand region and currently many algal strains are maintained in our algae laboratory, including *Chlorella* sp., *Scenedesmus* sp., *Monarphidium* sp., *Nitzschia* sp. and several species of cyanobacteria.

Further biochemical and molecular characterization of these strains is being carried out for proper identification of the isolates. Biomass and lipid productivity was also calculated gravimetrically for proper screening of these strains having ease of cultivation and high growth rate. These lipids can be converted into biodiesel through the process of transesterification. Further attempts have been made to grow these strains under stress, as it is reported that some algal strains show increased lipid productivity when grown in nutrient-depleted conditions[2,3]. Future studies are aimed at exploring indigenous microalgal strains for biofuel production from wastewater which can provide an economical and sustainable technology which could be commercialized in future.

1. Parvin, M., Zannat, M. N. and Habib, M. A. B., *Asian Fish. Sci.*, 2007, **20**, 117–124.
2. Shifrin, N. S. and Chisholm, S. W., *J. Phycol.*, 1981, **17**, 374–384.
3. Solovchenko, A. E., Khozin-Goldberg, I., Didi-Cohen, S., Cohen, Z. and Merzlyak, M. N., *J. Phycol*., 2008, **20**, 245–251.

NEHA CHAMOLI BHATT*
SUSHMA TAMTA

Algae Laboratory,
Department of Biotechnology,
Kumaun University, Nainital,
Bhimtal Campus,
Bhimtal 263 136, India
**e-mail: nehachamoli2508@gmail.com*

Do INSPIRE Camps achieve the desired goal?

I fully agree with Koul[1] that innovative mindset and scientific temper are important for science. It is a known fact that most of the inventions in science came from persons who were not brilliant in academics, but had analytical and critical minds, which led to great scientific inventions and discoveries. The INSPIRE programme initiated by the Department of Science and Technology (DST) to expose students of secondary schools to the basics of science across the country is commendable. However, the selection criteria based on marks or grades as pointed out by Koul[1] need a relook. It is not always that a student securing higher grades can make a good scientist as the top scorers mostly aspire to become doctors or engineers. Critical and analytical mind, observational skills and sense of creativity could make a best scientist. Selection criteria need to be based on scientific aptitude of the students and not on marks. A batch of about 100 students is sufficient for an INSPIRE Camp for thread-bare discussion and not a scientific mela of 200 or more students. Mentor–student interactions need to be made mandatory, as the mentors are mostly top scientists who leave after delivering their lecture due to their own pressing preoccupations, with no room for further interaction with the students. Furthermore coupled with lectures, practical aspects of science need equal emphasis based on the principle of learning by doing it oneself. Even in schools DST provides funding to students for developing innovative models. However, there is no further monitoring and when students bring their models most of them are not worth evaluating as they have been prepared hurriedly one or two days before the date of presentation. Only a few models speak of innovation and rest are a mere waste of money.

1. Koul, M., *Curr. Sci*., 2013, **105**, 145–146.

D. P. ABROL

Division of Entomology,
Sher-e-Kashmir University of Agricultural Sciences and Technology, FOA,
Chatha 180 009, India
e-mail: dharam_abrol@rediffmail.com